butterfly which possesses a remarkable directional control enabling it to return to its Mexican overwintering sites in the fall.

Risks of dispersal, however, are very real. Many migrating insects are carried to hostile environments where they perish, such as snow-covered peaks (Edwards, Chap. 14). Curiously, the fallout of these "derelicts of migration" becomes the basis of a scavenger and predator community, and may hasten the recolonization of huge disturbed areas such as the blast zone of Mt. St. Helens.

In a very interesting chapter, Farrow (Chap. 13) explains the concepts of the boundary-layer and synoptic scale meteorology, and how atmospheric processes help us understand migration of micro-insects (insects that are less than 1.5 cm in length). Maybe someone familiar with meteorology would not be impressed, but I found this chapter very instructive. By flying at night insects appear to utilize the nocturnal temperature inversion in the planetary boundary level. Several chapters deal with night-flying insects. Danthanarayana (Chap. 7) discusses the lunar periodicity in insect flight. Riley and Reynolds (Chap. 6) give an overview of various cues that may be used by night-flying insects for orientation, while Danthanarayana and Dashper (Chap. 8) focus on one of these cues: polarized light from natural sources. Mikkola (Chap. 11) describes the effect of wind on insect migrations into Finland.

Endocrine stimulation of migratory behavior, and endocrine control of flight metabolism are discussed in Chap. 3 and Chap. 4, respectively. Four chapters deal with applied topics: Chap. 15 and 16 with migration in *Heliothis zea* and relatives, Chap. 17 with dispersal models of agricultural pests, and Chap. 18 with insects of public health importance. Several chapters are concerned with developing techniques for tracking migrating insects. Sounds produced by insects are important because wingbeat frequencies of insects can be detected by radar (Belton, Chap. 5). Lingren et al. (Chap. 19) describe the uses of night-vision equipment for observation of insect behavior at night.

In summary, this volume will be of interest to many workers in the field of insect flight. While not attempting to give a comprehensive overview of all aspects of insect flight, this book (especially if read in combination with a more physiologically oriented volume of the same title (*Insect Flight*. Goldsworthy, G. J., and Wheeler, C. H. (eds.). 1989. CRC Press, Boca Raton) serves a valuable function by bringing together different perspectives on insect migration, ranging from biochemical to evolutionary. In this age of increasing specialization, such attempts should be encouraged.—*Peter Turchin, So. Forest Exp. Station, Forest Service-USDA, Pineville, Louisiana 71360.*

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Biogeography and Taxonomy of Honeybees.—Friedrich Ruttner. 1988. Springer-Verlag, New York. xii + 284 pp. $87.50 (hardcover).

The biology and morphometrics of honeybees have received increasing attention over the past decade because of the problems encountered in the Western Hemisphere with the Africanized honeybee. For such a small genus, *Apis* is one of the most widespread and, in human eyes, dominant groups of insects. However, up until

Ruttner's work, there has been no thorough, comparative source which summarizes information on the species and races of honeybees.

The book is basically organized in 3 parts. First, a general overview of the genus *Apis* is given, which includes discussions of biology, phylogeny, and geographic variation. Second, are detailed discussions of the distribution, morphology, biology, and to some extent physiology of each species. Finally, the last chapters, comprising nearly half the book, are devoted to discussions of each geographic/morphometric race of *Apis mellifera* L. recognized by the author.

The text is clearly written but terse. In fact some discussions become almost telegraphic. I find this a pleasant change from similar types of studies which tend to expand a small amount of information into a large amount of verbiage. However, some chapters, particularly the introductory ones, would have benefitted from more extensive discussions. Somehow one paragraph on the ecology of honeybees seems inadequate. It is easy to see where the author's interests lie, as comparatively speaking, he waxes poetic in his discussions of the races of *Apis mellifera.* Overall the book is well organized, beautifully illustrated and informative.

The chapters on species and races of *Apis* provide information on each of these groups in a clearly organized, comparative manner. For each species there is a discussion of morphology, particularly that of the male terminalia; distribution; behavior, including comparisons of dance language, foraging activities, swarming and colony defenses; morphometrics; physiology; parasites, and relationships with man. Discussions of *mellifera* races are arranged by general geographic region, and include taxonomic problems, precise distributions, morphometric characteristics and behavioral peculiarities.

I have several complaints with this work. The first is a matter of nomenclature. Throughout the text Ruttner refers to "races of honeybees" and yet the names he uses are clearly subspecies. He even proposes the name *Apis mellifera macedonica* ssp. nova as a new subspecies, but in the diagnosis he calls it a race. I find this confusing, as strictly speaking, races are not given official names according to the Zoological Code of Nomenclature. There is also the phrase: "two new *Braula* species of the genus Megabraula . . ." which is unclear and may just be a problem of translation. Second, the study of Winston and Michener (1977) is cited repeatedly as the final word on the phylogenetic relationships of the apid subfamilies. The later study by Kimsey (1984) made some corrections of the earlier paper and provided additional characteristics. Ruttner actually does cite this 1984 paper in his references but I could find no reference to it in the text. Finally, to my knowledge, no one has been able to demonstrate resource competition between honeybees and native bees. The statement: "Therefore it seems that the bigger [*Apis*] species avoid disastrous competition by shifting to other more distant [food] sources" has to be my favorite.

I do have one final criticism, which is addressed to the publisher: the price of this volume is outrageous, and will discourage many interested individuals from buying a copy.—*Lynn S. Kimsey, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138.*

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Tree and Shrub Insects of the Prairie Provinces.—W. G. H. Ives and H. R. Wong. 1988. Information Report NOR-X-292, Northern Forestry Centre, Canadian Forestry Service, Edmonton, Alberta, xi + 327 pp.

This pictorial guide to identification of arthropods that feed on trees and shrubs in the Prairie Provinces culminates the authors' work in that region of Canada; each has devoted about 40 years to the study of forest entomology. They have produced an outstanding manual, one useful to researchers, extension entomologists, horticulturists, and plant inspectors working in regions well beyond the area of coverage. Species affecting native trees and shrubs of the forest vegetation are emphasized (some common exotic plants of field and farm shelterbelts are included), but this volume will interest those who work with ornamentals.

Tree and Shrub Insects of the Prairie Provinces is aesthetically pleasing throughout—from its striking and unique cover illustration (larva of forest tent caterpillar on a black background), well-conceived, consistent layout of species write-ups, to the superb color plates. Included among the 117 plates featuring about 1,100 photographs are some of the best images of insects and their injury that we have seen. Depth of field and lighting are remarkably consistent, and the reproduction is excellent. Even their poorest figures, perhaps 45D (carpenter ant nest) and 61G (gypsy moth larva), are better than the majority of those in some publications.

Despite numerous color plates, the book is functional, not extravagant. It was laid out with the reader in mind; as an example, the 8″ × 11″ pages have margins sufficient for making notes. Paper stock is coated and heavy enough to minimize "see-through"; the binding (perfect, double score hinged) should hold up under extensive use.

A one-page introduction covers objectives and organization of the manual. Introductory material also includes line drawings of adult and immature insects showing various structures (setae of the geometrid larva in Figure 1H cannot be seen, and ocelli might have been indicated for some larvae) and a short glossary. Cremaster is defined as the "terminal abdominal segment" of a pupa but actually is the *apex* or *hooked process* of the last segment.

Insects that feed on conifers and on hardwoods are segregated in the table of contents and arranged in each category by plant part attacked (e.g., seeds and cones, foliage, buds or shoots). Mites, caterpillars, sawflies, beetles, and other groups are broken out under plant parts, and each arthropod group is further subdivided to facilitate identification. For instance, lepidopterans attacking conifer foliage are separated into budworms, caterpillars, loopers, miscellaneous larvae, and tube makers. Caterpillars, for example, are further subdivided into the spruce harlequin and its allies, hairy or spiny larvae, and colorful or bizarre larvae.